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ABSTRACT

Thirty-three two-year dental hygiene programs throughout the United States were surveyed to identify the radiographic imaging system most often used and the accompanying rationale for that decision. A literature review identified the three radiographic imaging systems most frequently used and indicated that all dental hygiene programs had the objective of using the technique and film group that produced a radiograph with as little radiation exposure as possible but with an excellent quality film for diagnostic purposes. The radiographic systems identified in the literature review were included in the survey: D-speed film, E-speed film, and xeroradiography, and a column was provided for other systems. The majority of respondents (55 percent) indicated E-speed film as the film choice, evidencing a concern for protecting the patient from minor amounts of excess radiation. Respondents indicated that the XCP paralleling technique was important to production of a good radiograph, but not always possible. Xeroradiography, which further reduces radiation exposure to the patient, was not used by any of the programs. Use of the panorex (the only "other" system identified) coupled with an adequate bite-wing survey could be a viable option, but did not seem to be employed in dental hygiene programs. Teaching of all types of radiographic imaging in the dental hygiene curriculum was recommended. (Appendixes include a 10-item bibliography, the survey instrument, and some survey responses.) (YLB)

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ED347298

A STUDY OF RADIOGRAPHIC IMAGING SYSTEMS
USED FOR DENTAL HYGIENE

A Thesis Submitted to the Graduate School in Partial
Fulfillment of the Requirements for the
Degree of Master of Science

by
Nancy S. Karst

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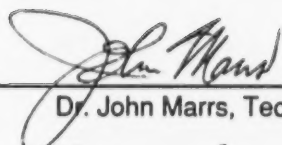
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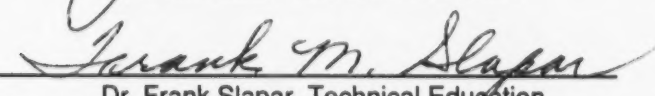
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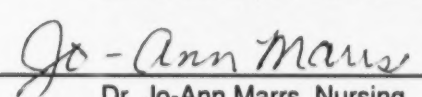
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A STUDY OF RADIOGRAPHIC IMAGING SYSTEMS
USED FOR DENTAL HYGIENE

An Abstract of the Thesis by
Nancy S. Karst

This research was conducted to identify the radiographic imaging system most often used in two year dental hygiene programs. The research indicates which system produced the most accurate image with the least amount of radiation to the patient. There seemed to be discrepancies between what the reviews of literature indicate and which systems were actually being employed in dental hygiene programs. The intention of the study was to determine which systems were actually being used in two year dental hygiene programs, and if funds were a primary consideration in the decision to choose a particular method or machine. Programs associated with dental schools were eliminated because these programs have more equipment available for utilization.

Questionnaires were mailed to randomly selected associate degree dental hygiene programs throughout the United States. The questions asked were structured to determine which systems were used and why the system was chosen. There were specific selections given, as well as an "other" space to allow the re-

spondents to indicate a response that was not represented in the selections.

Survey results indicated that the E-speed film group is most often being employed with the paralleling technique. The bisecting technique is being taught along with the paralleling so the operator may produce an adequate film of an area when paralleling is impossible. The results also indicated that lack of funds prevented changes that needed to be made in the radiology department.

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CHAPTER I

INTRODUCTION

The researcher investigated the different radiographic imaging systems employed in dental hygiene programs. The traditional radiographic imaging system incorporates the use of D-speed film used intraorally and the common x-ray machine with a position indicating device (PID) aligned to properly project the shadow of the tooth onto the film as a latent image. Other systems investigated were the panoramic radiographic technique and the xeroradiographic process. The latter is similar to the D-speed film technique except it uses a different film and processing method. The panoramic radiographic technique is an extraoral film technique producing one film of the entire dental arch.

The Statement of the Problem

The researcher investigated radiographic imaging systems to determine which one or ones are employed in dental hygiene programs.

The subproblems determined the use of the conventional radiographic imaging system, the panoramic radiographic imaging system, and the xeroradiographic imaging system in dental hygiene programs.

Definition of Terms

ALARA -	The acronym for "As Low As Reasonably Achievable."
Arch -	An arch formed by the alveolar process and teeth on either jaw.
Calculus deposits -	Build up of hard deposits on the tooth. Commonly referred to as tartar.
Carious lesions -	Decay of the tooth.
Dental arch -	The teeth and underlying structures.
Dental hygiene -	The profession involved with cleaning teeth and providing support functions such as taking radiographs, patient education and expanded functions.
Extra oral -	Procedures accomplished outside the oral cavity.
Film Sensitivity -	Film sensitivity determines how much radiation for what period of time is necessary to produce an image on the film. The American National Standards Institute designates film speed groups A through F. A is the slowest and F is the fastest. (1, 40-41)
Intensifying screens-	Screens that are sometimes used with x-ray film to increase the radiation without increasing the exposure time. (1,146)
Interproximal -	Between two adjoining teeth.
Intra oral -	Inside the oral cavity.
KVp -	(Kilovolt peak,) Used in radiology to describe the kilovoltage setting on the control panel.

Latent Image -	An invisible image formed on the radiographic film because of exposure to x-rays that is made visible by the development process.
mR -	The abbreviation used for millirad.
Palate -	The roof of the mouth.
MSSC. -	The abbreviation for Missouri Southern State College.
Panoramic radiographic imaging system -	A radiographic procedure that provides a panoramic view of an entire dental arch on one film. The film is placed on a drum and rotates around the patients head as the film is exposed by the radiation emitted from a PID attached opposite the drum.
Periapical -	Around the root of the tooth.
Periodontal -	Structures surrounding the tooth.
Periodontal Disease -	Disease of the structures surrounding the tooth.
PID -	A commonly used abbreviation for position indicating device, which is the cylinder used to direct the x-rays to a specific area.
Radiograph -	A record produced on a photographic plate, film, or paper by the action of roentgen rays.
Xeroradiography -	An imaging system that uses xerographic copying process to record the latent images onto opaque paper that can be viewed directly or by reflected light from a viewbox.

Significance of the Study

The common x-ray technique employed in dental hygiene programs is the intraoral D-speed film techniques. This one is currently included as a part of the regional examination that graduates of MSSC take upon completion of the program. The panoramic radiographic technique is employed in many dental offices as a technique to either replace some of the films taken by the intraoral techniques or as an augmentation to the intraoral techniques. The xeroradiographic system is not as popular as the other two systems due to its difficulty in handling. The study identified which system or systems are employed in other dental hygiene programs and the accompanying rationale for their decision.

Assumptions

There continues to be a need for radiographs as a diagnostic aid for diseases of the mouth and there is a continued need for the use of panographic radiographs. There is an interest in using the xeroradiography system in place of or as a supplement to the conventional radiographic imaging system to identify specific structures that are more readily identified with this system than the conventional radiographic system. Dental hygiene schools are using D-speed

intra oral film techniques as well as panoramic radiographic techniques.

Delimitations

The research was limited to the study of which system or systems should be used or are currently in use in other dental hygiene programs and the rationale for their use.

Limitations

This study was dependent upon data supplied by respondents to the research questionnaire. The respondents' knowledge and attitude toward the radiographic systems influenced the responses, and provided information regarding the use of these systems.

CHAPTER II

REVIEW OF LITERATURE

In reviewing the literature on radiographic imaging systems, the three most often used and written about are the conventional D-speed and E-speed films, xeroradiography, and panoramic radiography. The research periodicals have many articles comparing D-speed, E-speed and xeroradiography for intraoral techniques. The research is inconclusive, leaving the conventional D-speed intraoral film technique the most commonly used in most dental offices. "This technique allows a reduction in radiation to the patient by a factor of fifty." (8,787) This a tremendous improvement from the techniques formerly used in dentistry. Current controversy is over the use of E-speed film which reduces the radiation exposure time further. The differences in exposure time between the two methods is measured in tenths of a second. This minimal amount of exposure time difference and the loss of diagnostic quality in E-speed film, according to some, has kept most dental offices from changing to this speed group. Dental film has silver bromide crystals imbedded in a gelatin base. Crystals that are larger

in size allow for a reduction in exposure time:

Definition or detail on a film is also dependent on the size of the silver bromide crystals. The larger crystals, although they allow for reduced exposure time, give poorer definition when compared with the smaller, slower crystals. (1,42)

Some dental practitioners feel diagnostic quality is lost because of the larger grain size, thus rendering the film not useable, while others feel the reduction in exposure time is worth the change in diagnostic procedures. The latter practitioners feel that diagnosis is possible with practice in reading the films. However, the minimal difference in time exposure has made the whole question a moot point.

Xeroradiography, a system not routinely used in dental offices, is another possibility for consideration. This system produces an image that has excellent definition which means the images on the film are sharp and clear. The definition is especially good in the structures surrounding the tooth giving a clear outline of these structures. This is important for periodontal (around the tooth) diagnosis. "Xeoradiography is an excellent imaging system to use in detecting periodontal disease." (1,283) Dental hygiene is primarily concerned with the structures surrounding the teeth such as the gums, so this imaging system

would be an excellent consideration for dental hygiene programs.

Xeroradiography requires less radiation because the film is replaced with a photoreceptor plate enclosed in a cassette, thus forming a latent electrostatic image. (1) The cassette is thicker and stiffer than film which makes it more difficult to handle and is uncomfortable for the patient.

According to Katsanulas and Lambrianidis, xeroradiography, requires about one-third the dose necessary for conventional radiographs and should be a valuable alternative to conventional radiographs for detecting carious lesions (decay), calculus deposits (tartar) and periodontal disease (gum disease) as well as periapical (root) structures. (7) Upon further investigation, it is suggested that xeroradiography shows more image artifacts thus, a higher retake rate due to the artifacts. (3) Generally, it is agreed that xeroradiography gives better diagnostic quality except for the image artifacts around metallic restorations which are difficult to read. The biggest problem with this technique seems to be with the operator, as the xeroradiographic cassettes are significantly more difficult to use for complete mouth radiographs than comparable conventional film packets. The greatest shortcoming is its greater thickness and rigidity as well

as its reduced internal surface area. (2)

Another cassette type film in use today is the panoramic radiograph. This radiograph produces one film with both the upper and lower dental arches by a drum rotating around the patient's head. The drum holds the extraoral film in a cassette with the fluorescent screen that enhances the radiation, thus reducing the amount of radiation needed to produce the image onto the film. The film produced is either five inches by twelve inches or six inches by twelve inches.

Due to the size of the film, the definition is not as good as the periapical D-speed film. Some dentists consider that a good reason not to employ the panorex as the only film consideration. It is used primarily as an adjunct to conventional films, although, it is capable of producing images not available with conventional film. Many times, the panorex film coupled with interproximal (between the teeth) projections using D-speed film, is an adequate complete mouth survey, and is routinely used by many dental offices. The panoramic radiograph includes a larger area, including more structures on the radiograph. It has better patient acceptability because films are not placed in the patient's mouth. (1)

Use of the conventional D-speed film has been the accepted technique, thus every technique will be compared to it or will be used in conjunction with this technique. The use of E-speed film is gaining acceptance as an alternative technique due to the reduced radiation required. Xeroradiography is also a choice for reduced radiation.

A search of Medline through Axe Library on the Pittsburg State University Campus was accomplished. The literature reported studies on the comparison to D-speed and research reported about panoramic radiology and its use.

In summary, the literature review provided information about the radiographic imaging systems. The articles are specifically oriented to reporting about the quality of films. The institutions that have conducted the research have not reported which systems are currently in use and the rationale for their choice.

It is generally accepted that paralleling is the preferred technique as it produces a more dimensionally accurate film with less radiation to the patient. Paralleling is very difficult to accomplish when the patient has a shallow palate or a narrow arch making placement of the film parallel to the tooth virtually impossible.

The technique and film group used to produce a radiograph with as little radiation exposure as possible, yet remain an excellent quality film for diagnostic purposes is the objective of all dental hygiene programs.

CHAPTER III

RESEARCH PROCEDURES

Introduction

A computer search of materials available for the radiographic imaging systems was accomplished. The materials were then reviewed and evaluated for information concerning the different radiographic imaging systems and their use in dentistry, specifically in dental hygiene programs.

A questionnaire was constructed to inquire of dental hygiene programs the radiographic imaging system or systems currently used. The questionnaire also inquired about systems formerly used and those under consideration. The instrument included questions to determine the reason for the system selected.

The questions were closed-end items with an "other" category where appropriate. Also included were areas for comment to receive feedback about the survey or systems mentioned in the survey.

The three radiographic systems considered were the D-speed and E-speed film, xeroradiography, and the panoramic survey because of the interest evidenced in the literature review. Items involved with conventional radiography were included in questions concerned with which exposure method is used, as the

exposure method as well as the system used is an indication of the quality of the films being produced.

Description of Population

A list of dental hygiene programs in the United States, and a list showing the division of the states into their respective districts was obtained from the American Dental Hygiene Association. A random sample of the associate degree programs from each district were chosen to allow for equal geographical distribution.

Procedure

The survey instrument was mailed to the director of the dental hygiene program. An introduction to the survey instrument preceded the questions in a transmittal letter. A self-addressed stamped return envelope was included. The letter identified the purpose of the study and requested a date for return of the questionnaire.

Treatment of the Data

The data was processed by tallying each item. A percentage is given for each item so the reader can examine the weight of the responses. The "other" responses were categorized and listed in the Appendices. Tables were provided to show the results of each

category. The tallied data are reported in tables with an explanatory narrative. The comments section are reported in separate tables except when it was more appropriate to include those with the related questions.

The summary includes information about the results of the survey and indicates preferences for a particular radiographic imaging system. Also included in the summary is the reason the respondents gave for the selection of a specific system used in the radiology department of their dental hygiene program.

CHAPTER IV

RESULTS OF SURVEY

The questionnaires were mailed with an enclosed self-addressed stamped envelope for return of the survey. The questionnaires primarily requested information concerning the type of radiographic imaging system used in the program and why the specific system was chosen. The results of the survey are summarized in tables and explained in narrative form.

Of the forty-five questionnaires mailed, thirty-two responded. Phone calls were placed to the remaining thirteen dental hygiene programs. Only one school contact was successfully completed; and the other schools were either not in session, or not available according to the answering machine. The radiology instructor of the one contacted by phone graciously answered the questionnaire by phone as no one was aware of the location of the questionnaire. The total number of respondents was thirty-three giving a response rate of 73 percent. The no response rate from twelve indicates 27 percent did not respond.

Only two of the respondents wrote questions or comments concerning the survey as a whole. One of these suggested another area that could have been included and the the other comment was a request for the results of the survey.

The following table and narrative are presented to address the first question which asked; "Which type periapical film is used?"

TABLE I
TYPE OF PERIAPICAL FILM USED (N=33)

	Number	Percentage*
D-speed	10	30
E-speed	15	55
Xeroradiography	0	0
Other	3	9

*Does not total 100% due to rounding

The literature indicated that the E-speed film group is preferred because of the reduced time needed to expose the film, thus reducing the radiation exposure to the patient; however, there was reported evidence of substandard films due to the large grain size in the emulsion of the film. The survey indicated that eighteen (55 percent) of the respondents were using E-speed film, ten (30 percent) are using D-speed film, and zero respondents are using xeroradiography which requires less radiation than either the D-speed or the E-speed film group. Xeroradiography is much more difficult to expose and process than the other two speed groups. Of the three respondents selecting the other category, two made no comment, and one indicated the

panorex system was being used. Two respondents selected multiple answers indicating more than one type film being utilized. One of the respondents indicated the use of D-speed film on laboratory manikins and E-speed film for patients. The other respondent indicated Kodak ultra-speed film in the comment section, which is the same as D-speed film.

Question No. 2 inquired about the "Reason for selection of film group in Question No. 1."

TABLE II
REASONS FOR SELECTION OF FILM GROUP (N=33)

	Number	Percentage
Film cost	2	6
Ease of use	1	3
Final product	5	5
Decreased radiation	20	61
Other	2	6
Multiples	3	9

Two respondents (6 percent) indicated they selected the film in Question No. 1 because of the the cost of the film. One respondent (3 percent) indicated their selection was due to ease of use, five respondents (15 percent) felt the final product was better with their choice, and 20 respondents (61 per-

cent) indicated their selection was based on the reduction of radiation exposure to the patient. Two respondents (6 percent) selected the other category, and three respondents (9 percent) indicated multiple answers. The "other" category selected by two indicated that the D.D.S. involved objected to use of E-speed film, and the film currently in use was being used when the instructor began teaching. The second respondent indicated there were too many processing errors with E-speed film. Three respondents (9 percent) chose Multiple answers. Two of them indicated ease of use and reduction of radiation exposure, and one indicated the two aforementioned reasons plus cost of film as the reason for selection of the film group in the first question.

Question No. 3 of the survey was included to determine which technique was being used to augment the film group selected, therefore determining the system to produce the best overall quality film. These responses are summarized in Table III. None of the respondents are using the UpRad VIP (Versatile Intraoral Positioner). Five (15 percent) are using the Rinn XCP paralleling device, none are using the snap-a-ray device only, and three (9 percent) are using the Stabe device exclusively. Five respondents selected the "other" category in conjunction with the multiple an-

swers, which were nineteen (76 percent) of the total.

The combinations being used are the following:

Rinn XCP and Snap-a-ray
Rinn XCP, Snap-a-ray, and Stabe
Snap-a-ray and Stabe

TABLE III
INSTRUMENT/TECHNIQUE USED (N=33)

	Number	Percentage
VIP	0	0
XCP	5	15
Snap-a-Ray	0	0
Stabe	3	9
Other	0	0
Multiple	19	76

Those selecting one of the aforementioned combinations and indicating another selection constituted 15 percent (five) of the total multiple answer section. The instruments indicated were as follows:

Rinn XCP, Snap-a-ray, Rinn BAi
Rinn XCP, Snap-a-ray, Stabe, Precision
Rinn XCP, Snap-a-ray, Stabe, Snap Ex
Rinn XCF, Uni-bite
Rinn XCP, Snap-a-ray limited amount

The school indicating the Uni-bite indicated the instrument did not work properly.

The next question asked; "Why they chose the instrument in Question No. 3?" The responses are summarized in Table IV.

TABLE IV
REASON FOR CHOICE OF INSTRUMENT/TECHNIQUE (N=33)

	Number	Percentage*
Equipment cost	0	0
Film cost	0	0
Ease of instruction	3	9
Common product	3	9
Preferred technique	12	36
Other	3	9
Multiples	12	36

*Does not total 100% due to rounding

The cost of equipment and cost of film selections were not a factor for any of the respondents. Three respondents (9 percent) selected "ease of instruction" as the singular reason for their choice, and three respondents (9 percent) indicated their choice was based on the most commonly used product in the area. Twelve respondents (36 percent) indicated their selection was the preferred technique, while three respondents (9 percent) indicated the "other" category and twelve

respondents (36 percent) indicated multiple selections including the "other" category. The most commonly chosen multiples were:

- Ease of instruction
- Most commonly used product in the geographic area
- Preferred technique
- Other

The many responses in the "other" category are listed in Appendix B. Generally the responses indicated the person chose the instrument in Question No. 3 because they felt it produced a more dimensionally accurate pericapical film, or that it is necessary to teach more than one technique so the hygienist is prepared to solve special problems as they arise. Sometimes the instrument chosen was the most commonly used instrument in private practice in that geographical area. Another reason mentioned was to allow students to learn basic steps of procedure prior to learning alternate techniques needed in special instances when the oral cavity size is too small or too narrow to allow use of paralleling equipment.

The next question asked; "Which technique is taught in their dental hygiene program?" Table V is provided to summarize the responses.

TABLE V
TECHNIQUE TAUGHT (N=33)

	Number	Percentage
Bisecting the angle	0	0
Paralleling	4	12
Both	28	85
Other	1	3

None of the schools surveyed taught the bisecting technique exclusively, four (12 percent) taught paralleling exclusively, twenty-eight (85 percent) taught both techniques. The one person responding in the other category exclusively indicated the techniques being taught were the rectangular PID and the panorex.

The next question asked; "Why the technique in Question No. 5 was selected?" These responses are shown in Table VI. Two respondents (6 percent) felt their selection was the preferred technique, ten (30 percent) responded that paralleling produces a dimensionally accurate image, six (18 percent) chose "other" exclusively, while fifteen (45 percent) indicated multiple selections. The multiple selections and the

"other" selections are listed in Appendix B.

Generally, the comments listed indicated a need for students to know both techniques so an accurate film can be produced, fundamentals of shadow casting must be taught, and bisecting must be taught so the student is able to take a radiograph of a patient with a shallow palate or narrow arch.

TABLE VI
REASON FOR TEACHING THE TECHNIQUE CHOSEN (N=33)

	Number	Percentage*
Preferred technique	2	6
Bisecting is dependable	0	0
Paralleling deficient	0	0
Paralleling easier	0	0
Paralleling better	10	30
Other	6	18
Multiples	15	45

*Does not total 100% due to rounding

Question No. 7 asked; "Which configuration was representative of the survey taken in their program?" Sixteen (48 percent) responded that an eighteen film survey (14 periapicals with 4 horizontal bitewings) was taken, six (18 percent) indicated a twenty film survey (four #2 posterior periapicals, four #1 anterior periapicals per arch and four horizontal bite-

wings were used, three (9 percent) indicated the "other" category exclusively, and eight (24 percent) indicated multiple answers. Table VII is provided to summarize the information. The individual answers to the "other" category and the multiples are listed in Appendix B.

TABLE VII
FULL MONTH SURVEY MOST COMMONLY USED (N=33)

	Number	Percentage*
8 film (4 HBW's)	16	48
21 film (7 VBW's)	0	0
16 film (2 HBW's)	0	0
20 film (8 #1 ant)	6	18
(4 HBW's)		
Other	3	9
Multiples	8	24

*Does not total 100% due to rounding

Question No. 8, summarized in Table VIII asked; "Why the respondents preferred the survey chosen in Question No. 7?" Eleven (33 percent) selected "Diagnostic value", two (6 percent) selected "Reduction of radiation exposure," three (9 percent) selected "Periodontal diagnosis enhanced", none selected "Caries detection enhanced", five (15 percent) selected "Other", and twelve (36 percent) selected multiple answers.

TABLE VIII
REASON SURVEY INDICATED IS PREFERRED (N=33)

	Number	Percentage*
Diagnostic value	11	33
Radiation reduction	2	6
Perio enhanced	3	9
Caries enhanced	0	0
Other	5	15
Multiples	12	36

*Does not total 100% due to rounding.

The comments listed in the other category are as follows:

- fits anterior region better
- smaller mouths often need a smaller size fil
- state board requirement
- total coverage of all areas with fewer films
- because of the ALARA concept.

The multiples chosen are indicated as grouped by the respondents:

- Diagnostic value and reduction of radiation exposure and carries detection enhanced.
- Diagnostic value and periodontal diagnosis enhanced
- Reduction of radiation exposure and periodontal diagnosis enhanced

-Diagnostic value, reduction of radiation exposure periodontal diagnosis enhanced, and Caries detection enhanced.

As questions nine and ten have a tendency to overlap one another, Table IX is used to list the film speed group with the accompanying milliamperes and kilovolts. Two of the respondents included the complete chart indicating the impulses or seconds employed with each periapical exposed. One of the respondents indicated that the settings varied from tubehead to tubehead, but the machines are calibrated so each exposure delivers about 90-100 mR per film. One of the respondents indicated their program used a different setting for exposures on children, thus reducing the radiation.

TABLE IX
EXPOSURE SETTINGS AND FILM TYPE (N=33)

Film group	Setting	Number*
D-speed	10mA/90kVp	1
	15mA/70kVp	1
	10mA/80kVp	2
	15mA/85kVp	1
	15mA/90kVp	2
	15mA/90kVp	2
	Variety	3
E-speed	15mA/80kVp	1
	15mA/90kVp	4
	15mA/70kVp	1
	10mA/90kVp	4
	7mA/70kVp	2
	6mA/7kVp	1
	Variety	7
Other	No Answer	2
	10mA/70kVp Child	
	15mA/90kVp Adult	1
Xeroradiography	No responses	

*Number does not total 33 due to multiple responses on some items.

The time used in conjunction with the settings listed above varied in conjunction with the settings employed and the PID length used.

Since research indicates the use of E-speed film as the preferred technique and xeroradiography produces a better film, the survey requested information about the use of xeroradiography as well as the two most commonly used film groups. Apparently this technique is not used as this area was consistently left blank throughout the survey. The survey also indicated that only one respondent indicated the panorex was being taught.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

Comparison of D-speed film to E-speed film and comparison of both groups to xeroradiography has been the subject of many research projects. The quality of films produced with the least amount of radiation to the patient is the overall objective. In considering the best quality film, the technique used is extremely important. The long PID paralleling technique is generally accepted as the best for accurate reproduction of the image with as low as reasonably acceptable radiation (ALARA concept). The newest innovation is E-speed film to further reduce radiation and still maintain a similar technique. The use of xeroradiography would further reduce radiation exposure to the patient and produce an accurate film. The major problems in switching to this technique, are the introduction of a new film holding device that is uncomfortable to the patient, and the introduction of a new processing technique which is uncomfortable to the operator.

According to the survey, many schools have accepted the use of E-speed film as a viable option. This fact indicates that the problems associated with the film have been successfully solved. Hopefully, the report of the settings of the machines employed

will be helpful to the reader in determining proper machine settings for this film. This information coupled with assistance from the film company should provide the necessary information to switch to the E-speed film group if desired.

The survey also indicated that the schools are teaching long-cone paralleling technique as their primary technique, but find it necessary to teach bisecting the angle technique as an alternative for those special need patients that cannot tolerate the parallel film. The survey also indicated the instrument of choice was the Rinn XCP over the UpRad VIP for paralleling. The instrument of choice for the bisecting technique seems to be the snap-a-ray holder as opposed to the stable holder.

Other possible combinations of techniques used in dental hygiene programs that were mentioned in the survey was the use of a rectangular cone in place of the round PID and the use of the panorex film. The responses indicated money was a problem in at least one school, although the researcher thinks this might be a problem in many programs. This may not have been mentioned because the schools are accustomed to working with this problem. There are many needs in the programs that are all very expensive due to the cost of dental equipment in general. The panorex machine

would be no exception as they are in the expensive category. Dental hygiene schools tend to teach the basic required curriculum and offer continuing education for enhancement of the hygienist's education and career. Instruction on use of the panorex can be easily introduced after one enters the career through the supply company, through continuing education, or through another professional. One could easily choose to learn another technique through continuing education and further study in a specific field including the use of xeroradiography.

Conclusions

The majority of the respondents (55 percent) indicated E-speed film as the film choice, which indicates there is a concern for protecting the patient from minor amounts of excess radiation. The respondents indicated the XCP paralleling technique is important to production of a good radiograph, but not always possible. With these two facts in mind, one could conclude that dental hygiene students are being taught to use the best technique with the fastest film speed. However, there is one more technique, xeroradiography, that further reduces radiation exposure to the patient, but is not being used by any of the dental hygiene programs. Also, the use of the panorex coupled with an adequate bitewing survey could be a

viable option, but does not seem to be employed in dental hygiene programs.

Recommendations

The core curriculum for dental hygiene does not require the inclusion of xeroradiography or panorex. The panorex might be a viable option to be included. The following list summarizes the recommendations:

1. More studies of this nature should be conducted.
2. More money should be made available so all types could be taught in the dental hygiene curriculum.
3. A cooperative effort between dental hygiene programs and dental offices which have the more sophisticated machines could be developed to allow training on those machines.
4. There should be more attempts to master the xeroradiography technique.

Steps taken to further reduce the radiation to the patient will let the public know that those involved with dentistry are interested in their well-being. With continued study in this area, it might be possible to solve some of the excessive radiation created in the medical field.

The current recommendation without the continued research in further radiation reduction, would be to

employ the use of the E-speed film group to allow for as little radiation as reasonably achievable. Also, dental hygiene programs could effectively employ the panorex system if funds were made available. With further research, the recommendation would be to encourage the use of xeroradiography.

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APPENDIX A

Nancy S. Karst, RDH
3502 Willow Lane
Joplin, Mo 64801-1458

April 15, 1992

Dear Director;

The enclosed questionnaire is part of a study concerning the use of radiographic imaging systems. The questionnaire is being sent to two-year dental hygiene programs to ascertain the technique or techniques used by the program.

Each question has a space for "other" for you or someone you designate, to indicate a system or systems not mentioned in the selections. Please feel free to indicate comments you may have regarding the selections as well as other systems employed.

Your cooperation in this project is most appreciated. Please return the questionnaire by May 10, 1992 in the enclosed self-addressed stamped envelope.

Thank you for your assistance.
Cordially,

Nancy S. Karst, RDH

RADIOGRAPHIC SYSTEMS SURVEY INSTRUMENT

This questionnaire is part of a study concerning the use of radiographic imaging systems.

Would you please take a few minutes to answer this inquiry about the radiology course in your dental hygiene program?

After each question there are several choices, please indicate your choice or choices in the blank to the left of the question number. If the choice "Other" applies, please indicate specifically what is used in the blank provided.

1. Which of the following do You use for periapical films?
 - A. D-speed film
 - B. E-speed film
 - C. Xeroradiography
 - D. Other _____

2. Why do you use the type film chosen in #1 above?
 - A. Cost of film
 - B. Ease of use
 - C. Final product
 - D. Reduction of radiation exposure
 - E. Other _____

3. Which instrument do you use to teach dental hygiene students to expose periapical radiographs?
 - A. UpRad VIP (Versatile Intraoral Positioner)
 - B. Rinn XCP paralleling device
 - C. Snap-a-ray film holder
 - D. Stabe bite block
 - E. Other _____

4. Why do you use the instrument mentioned in #3 above?
- A. Cost of equipment
 - B. Cost of film
 - C. Ease of instruction
 - D. Most commonly used product in your area
 - E. Preferred technique
 - F. Other _____
-
5. Which technique is taught the students in your dental hygiene program?
- A. Bisecting the angle
 - B. Paralleling
 - C. Both
 - D. Other _____
-
6. Why do you teach the technique mentioned #5?
- A. It is the preferred technique
 - B. Bisecting the angle technique is always dependable
 - C. Paralleling devices are deficient
 - D. Paralleling devices are easier for students to use.
 - E. Paralleling produces a dimensionally accurate image.
 - F. Other _____
-
7. Which of the following is representative of the full Mouth survey employed in your radiology program?
- A. 18 film (14 periapicals with 4 horizontal bitewings)
 - B. 21 film (14 periapicals with 7 vertical bitewings)
 - C. 16 film (14 periapicals with 2 horizontal bitewings)
 - D. 20 -film (four #2 posterior periapical, four #1 anterior periapicals per arch and 4 horizontal bitewings)
 - E. Other _____
-

8. Why do you prefer the survey indicated in #7?
- A. Diagnostic value
 - B. Reduction of radiation exposure
 - C. Periodontal diagnosis enhanced
 - D. Caries detection enhanced
 - E. Other _____
-

9. Which of the following would best represent the exposure settings employed by your radiology department?
- A. 10 mA/70 KVp
 - B. 15 mA/70 KVp
 - C. 15 mA/90 KVp
 - D. 10 mA/90 KVp
 - E. Other _____
-

10. Please indicate the exposure setting you employ with the type film used in your program.
- A. D-speed film
 - B. E-speed film
 - C. Xeroradiography
 - D. Other _____
-

Please return this questionnaire by May 10, 1992 in the enclosed self-addressed envelope. Thank you for your assistance with this project.

APPENDIX B

REASON FOR CHOICE OF INSTRUMENT/TECHNIQUE

Comments on Question No. 4

Better film quality.

Reproducible images.

Decreased radiation exposure.

They need to know more than one way to get the area they want.

Rinn XCP produces the most dimensionally accurate film, it standardizes the technique, it's reproducible.

Instrument utilized in private practice.

Least chance for failure.

XCP because it is the preferred technique

Snap-a-ray because of cost and it is the most commonly used product in the area.

Holds up for sterilization.

REASON FOR TEACHING THE TECHNIQUE CHOSEN

Comments on Question No. 6

Choices available:

- A. It is the preferred technique
- B. Bisecting the angle technique is always dependable
- C. Paralleling devices are deficient
- D. Paralleling devices are easier for students to use.
- E. Paralleling produces a dimensionally accurate image
- F. Other

The following multiple answer combinations were chosen once:

BDEF	EF
ED	AEF
BE	ABE
AF	DEF

The following multiple answer combinations were chosen twice:

ADEF

The following multiple answer combinations were chosen five times:

AE

FULL MOUTH SURVEY MOST COMMONLY USED

Comments on Question No. 7.

Choices possible:

- A. 18 film (14 periapicals with 4 horizontal bitewings)
- B. 21 film (14 periapicals with 7 vertical bitewings)
- C. 16 film (14 periapicals with 2 horizontal bitewings)
- D. 20 film (four #2 posterior periapicals, four #1 anterior periapicals per arch with 4 horizontal bitewings)
- E. Other

Multiples selected:

CD	AE
DE	AD
ABDC	AD
DE	

Comments listed under "Other"

20 film (four #2 posterior periapicals per arch, 5 maxillary anteriors with #1 film and 3 mandibular anteriors with #1 film)

Variety-students are taught to expose according to the patients needs.

20 film (four #2 posterior periapicals per arch, five #1 maxillary anteriors, three #1 mandibular anteriors, 4 bitewings)